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ABSTRACT

In problem-based learning, an instrument is needed to measure students' actual learning activities. Mapping the domain of learning activities undertaken by students and improving problems is especially important in a problem-based curriculum because students choose their own learning objectives. Such an instrument, the Topic Evaluation Questionnaire (TEQ), was developed. The TEQ's reliability and validity were assessed, as well as its usefulness as an indicator of problem areas in a course's content. Subjects were 125 second-year students attending the Medical School of the University of Limburg (Netherlands) enrolled in a childbirth and child development course. The TEQ contains 134 topics from the course and eight topics indirectly related but included to estimate response set effects. For each topic, a.Likert-type question was formulated to measure student perceptions of time they had spent studying the topic. Students were also administered a 222-item true/false type achievement test on the course material. In all, 210 achievement test items were classified by a teacher and an independent rater. The TEQ appeared to be reliable and was fairly valid. It appeared to be useful in measuring problem areas in course content, as well as student's actual learning activities. In sum, the T.E.Q. informs as to whether the goals set by teachers are reached by students. One table and one bar graph are provided. (SLD)

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Course improvement based on course content data: An explorative study conducted in a problem-based curriculum

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Over the past ten years problem-based learning has gained the reputation of a far-reaching innovative approach to education (Barrows & Tamblyn, 1980). The principal idea behind problem-based learning is that learning should be organized around problems which are related to the profession, rather than around subjects which are derived from academic disciplines. These problems usually consist of a description of a set of observable phenomena or events which are in need of some kind of explanation. Students analyze these problems, attempting to understand the underlying principles or processes through small-group discussion. In doing so, they activate whatever they already know about the problems. However, students' prior knowledge in itself is not sufficient to attain a deep understanding. During discussion usually some questions remain unanswered which subsequently serve as a guide for independent and self-directed learning (Schmidt, 1982).

New approaches to professional education need careful evaluation. This is particularly true for the approach described in this paper. In problem-based learning students are responsible for their own learning activities because they formulate their own learning goals. This implies that students choose their own topics and also decide how much time they will spend on studying each topic. As described above, problems are the starting-point for students' learning activities serving as a guide for formulating learning goals. Therefore, a high quality of problems is

essential for students' learning. Ineffective problems could probably lead to selecting learning goals not intended by the teachers. Consequently, the self-directed learning approach may cause uncertainties about students' competencies among staff and other parties concerned. In the long run, students' lack of sufficient knowledge will have negative implications for the quality of health care. Therefore, it is obvious that problem-based programs need adequate evaluation instruments to assess the effectiveness and quality of their innovation. These instruments should provide information about students' actual learning activities in relation to the problems in order to improve ineffective problems.

Usually, two methods are used to assess the quality of instruction: Educational outcomes, expressed as students' performances on various tests, and student ratings of the quality of instruction. Each of these methods has its own shortcomings. Achievement tests are usually applied to make decisions about students and to distinguish between good and poor students. However, achievement test scores by itself can not be used to improve curricula in order to enable students to achieve better. Student ratings of the quality of instruction are generally seen as an instrument which measures teaching behavior facilitating student learning and which in turn may provide data for educational improvement (Marsh, 1984). Nevertheless, this method still suffers from the limitation that it provides rather global information which does

not contain detailed information about the nature of the weaknesses. Consequently, these instruments can only be used to identify what should be improved in a course but not how this should be improved (Schmidt, Des Marchais & Black, 1989). This implies that more specific information is required. Such information should yield data about students' actual learning activities in relation to the contents of the course. However, students' actual learning activities, an important variable of the educational process, are usually ignored in evaluation studies. In general, educational researchers are inclined to neglect course content as a variable.

In summary, an instrument is needed to measure students' actual learning activities. Data gathered by means of this instrument should be applicable for mapping the domain of learning activities undertaken by the students and should be useful to improve problems. Such information is especially important in a problem-based learning context because of students' responsibility for choosing their own learning objectives. In this paper such an instrument is presented. Successively, the reliability and validity of this instrument, the Topic Evaluation Questionnaire (T.E.Q.), are assessed. The central focus of this paper is the usefulness of the T.E.Q. to acquire information about students' learning activities; in other words, is the T.E.Q. an appropriate instrument to indicate problem areas in a course content.

Method

Subjects

The study was conducted at the Medical School of the University of Limburg, the Netherlands. The first four years of the problem-based curriculum are structured as a series of six-weeks courses. In this study, 125 second year students in the 1989-90 academic year participated. These students attended a six-weeks course on the normal pregnancy, delivery and normal development of children and adolescents. The course contained thirteen problems concerning topics such as aspects of childbirth and psychosexual development. Students were randomly assigned to small-group tutorials.

Instruments

The instruments used in this study consisted of the T.E.Q. and an end-of-unit examination. The T.E.Q. contained a list of 134 topics covering the course content as intended by the teachers. In addition, eight topics, not directly related to the course content were included to estimate response set effects. For each topic a Likert-type question was formulated. Students were asked to indicate whether they had spent: No time at all (1), little time (2), a reasonable amount of time (3), much time (4) or very much time (5) on studying this particular topic. This question intended to measure students' perceptions about the time

they had spent on studying each topic related to the course. Time-on-task is generally considered as a major determinant of achievement (Carrol, 1963). Furthermore, self assessments appeared to be good predictors of academic performance (Shrauger & Osberg, 1981).

The other instrument used was an achievement test, including 222 items of the true-false type. Students' scores on this achievement test consisted of the percentage items correctly answered.

Procedure

At the end of the unit, students were required to fill in the T.E.Q. Next, the achievement test was administered to the students. In order to avoid that filling in the T.E.Q. could affect students' learning activities, the time span between the two measurement conditions was only 24 hours.

Analysis

One of the teachers and an independent rater were asked to assign the items of the test to one of the thirteen problems presented to students. Of the total of the 222 items initially included in the achievement test, six items were removed because of shortcomings in their formulation and six items were left out because they were related to extra-curricular activities. Thus, 210 items were actually classified. The two raters agreed about 135 items which could be assigned

uniquely to one problem. The interrater agreement was equal to .64. The topics of the T.E.Q. were initially derived from the thirteen problems. Therefore, there was no need to use raters to classify them. The analyses in this study were all conducted at the level of singular problems. For each problem average topic scores and average achievement scores were computed. The reliability of the T.E.Q. and the achievement test was determined by estimating coefficients alpha.

Results and discussion

Reliability

The coefficient alpha for the T.E.Q. and the achievement test were respectively .98 (134 topics) and .76 (135 items). The average coefficient alpha for each of the problem item sets of the T.E.Q. varied between .67 and .91 and for the achievement test between .06 and .58. These results supported the reliability of the T.E.Q. and indicated that the achievement test's reliability for certain problems was fairly low.

Criterion validity

Time to learn is an important variable to predict educational achievement. This means that a relationship between time spent on studying topics and the test item scores may be expected. A positive

relationship between the T.E.Q. and the performances on the test demonstrates the criterion validity of the T.E.Q.

To show this relationship an ANOVA was conducted. The dependent variable consisted of the average achievement scores for each

Table 1: ANOVA-analysis

Source of variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main effects	12.830	15	.855	19.640	.000
Time spent	1.260	3	.420	9.645	.000
Problem	12.203	12	1.017	23.351	.000
Time spent * Problem	1.188	31	.038	.880	.657
Explained	14.018	46	.305	6.998	.000
Residual	68.679	1577	.044		
Total	82.697	1623	.051		

of the problems. The independent variables involved (a) the average time spent on studying each problem, containing five levels; and (b) the thirteen problems. Table 1 shows the results of the ANOVA-analysis. These results indeed supported the criterion validity of the T.E.Q. Besides, it is interesting to note that the independent variable 'problems' explained more variance than the independent variable 'time spent'. This effect is most probably due to the questionable quality of the criterion instrument itself; particularly in view of the low average

coefficient alpha for some of the problem item sets of the achievement test. Another plausible explanation is the number of test items referring to the thirteen problems varying from 2 to 22. This seems to illustrate that the achievement test did not equally reflect the problems related to the course. Consequently, the overlap of the test content with the objectives domain specified by the teachers may be very low.

Discriminatory power

To judge whether the T.E.Q. is a useful instrument for indicating problem areas in a course content, time spent on studying topics connected to a problem should differ across problems. The material in this study indicated that differences between time spent on certain topics indeed differed across problems ($F(12,1623)= 23.660$, $p < .000$). The average time spent varied from 1.94 ($SD= .65$) to 2.96 ($SD=.71$), as indicated in Figure 1. The average time spent on studying the eight topics, not intended by the teachers was 1.51 ($SD= .59$). These results demonstrated that the T.E.Q. can be used to indicate problem areas.

Utility

The utility of the topic evaluation instrument to improve curricula can be illustrated by Figure 1. The results in Figure 1 showed that time spent on studying the different tasks varied between "no time at all" (1) and "a reasonable amount of time" (3). A reasonable amount

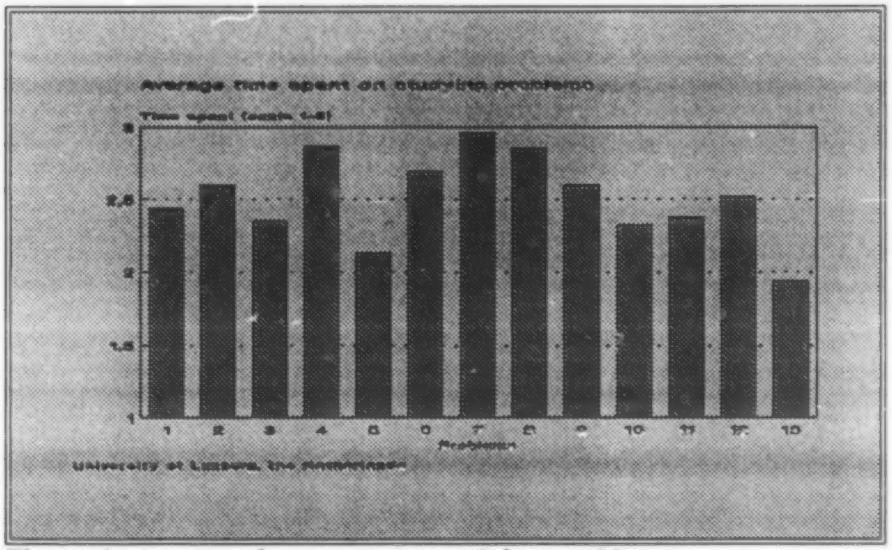

Figure 1: Average time spent on studying problems

of time had been spent on studying task four, seven and eight. On the contrary, little time had been spent on task five and task thirteen. Consequently, problem five and thirteen need to be improved in order to reach the goals set by the teachers. By examining the time students had spent on studying each separate topic related to that particular problem, teachers can collect information about how these problems should be improved. Thus, the T.E.Q. seems to be applicable to measure whether students' actual learning activities cover the course content.

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Conclusions

In problem-based learning students are responsible to choose their own learning activities. Problems serve as a guide in formulating learning goals. This self-directed learning approach may cause a gap between students' actual learning activities and those intended by the teachers. This implies that an instrument is needed containing information about which topics were studied by the students and how much time had been spent on studying each topic. This instrument's aim is to indicate how problems can be improved in order to reach the goals set by the teachers.

The T.E.Q. described in this study seems to meet these requirements. This instrument appeared to be reliable. Furthermore, it was shown that the instrument is fairly valid, which probably can be attributed to the low reliability of some of the problem item sets of the achievement test. The T.E.Q. appeared to be useful to indicate problem areas and can serve as an instrument to obtain specific information about students' actual learning activities. This information is particularly needed in an innovative curriculum based on the problem-based learning approach, because of the self-directed learning method. In summary, the T.E.Q. can indicate whether the educational goals set by the teachers are really reached by the students.

References

Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-based learning*. An approach to Medical Education. New York: Springer Publishing Company.

Carrol, J. B. (1963). A model of school learning. *Teachers College Record, 64*, 723-733.

Marsh, H. W. (1984) Students' Evaluations of University Teaching: Dimensionality, Reliability, Validity, Potential Biases, and Utility. *Journal of Educational Psychology, 76*, 5, 707-754.

Schmidt, H. G. (1982). *Activatie van voorkennis, intrinsieke motivatie en de verwerking van tekst*. (Activation of prior knowledge, intrinsic motivation and text processing). Apeldoorn: Van Walraven.

Schmidt, H. G., Des Marchais, J. E., & Black, R. (March 1989). *Theory-Guided Design of a Rating Scale for Course Evaluation in Problem-Based Medical Curricula*. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA.

Shrauger, J. S. & Osberg, T. M. (1981). The relative accuracy of self-predictions and judgments by others in psychological assessment. *Psychological Bulletin, 90*, 2, 322-351.